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NPIC/TSSG/RED-1766-69
15 August 1969

MEMORANDUM FOR THE RECORD

SUBJECT: Feasibility Study - Stereogram Printer Optical Development

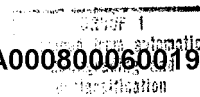
1. Under PAR 253 of the AL-14 contract with [] we initiated the subject feasibility study -- to run for 12 months from 1 July 1969. Meetings with Messrs. [] were held on 9 and 31 July, and between -- on 18 July -- with Messrs. [] of IEG. On the basis of these discussions plus internal RED analysis, certain optical system parameters were agreed upon at [] on 31 July 1969.

2. BACKGROUND:

The ultimate purpose of a Stereogram Printer would be to provide high quality stereo imagery readily available to P.I.'s for use with simple, low-cost stereoscopes. Complex anamorphic, differential zoom, and adjustable rhomboidal optics are frequently necessary to properly display, for stereo fusion, imagery from current camera systems with varying image geometries. Experimentation with electronic image correlation systems has proven that automatic registration of stereo images through optical elements is possible with adequate viewing resolution and promises to release the P.I. from burdensome mechanical adjustments and allow him to concentrate on the heart of his analytical task. Automatic equipment for these purposes will be expensive and perhaps prohibitive in large numbers. Under this PAR, [] will study the feasibility of developing an optical system for adequate reproduction of rectified stereo pairs from standard 2nd generation DP's. From their designs, [] will fabricate and assemble breadboard optics for one optical path and test its reproduction capabilities.

3. [] primary questions on 9 July 1969 dealt with the optical relationships of input format coverage, copy magnification, and output formats of the printer design. During ensuing analyses, some consideration was given to using the eventual output of such a printer with existing zoom microstereoscopes which will be in the inventory for some years yet. Because the combined minimum magnifications of these microscopes and a reasonable design of a projection-type printer will be

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too high (20 - X) for many P.I. functions, use of these microstereoscopes should be reserved for the unusual case. This is consistent with our aim of reducing inventories of expensive, complex microstereoscopes. The feasibility study of the optical system for such an Automatic Stereogram Printer is based therefore, on producing stereograms which can be analyzed with simple stereoscopes -- perhaps, much like the 3X and 8X Mirror Stereoscopes of the 1940's and 1950's and the Navy 2X and 4X stereoscopes of the early 1960's.

4. From these and additional analyses, involving ground coverage on standard input materials, it was decided that the following criteria would be transmitted by to the lens designers on or about 1 August 1969. (Completion and evaluation of the lens design formulas will require approximately three months.)

a. Try for minimum printer magnification of 2X, but be prepared to increase this if good optical design of 200l/mm system demands.

b. Minimum zoom magnification range of 2:1.

c. Output format coverage (for each half of stereo pair) of approximately 5" X 5" -- unless minimum magnification must be greater than 3X. (NOTE: These parameters are approximately related, as follows:)

	<u>Printer Magn.</u>		<u>Input Format</u>		<u>Output Format</u>
(Min)	2.0X	.	2.5" X 2.5"	=	5" X 5"
(Max)	4.0X	.	1.25" X 1.25"	=	5" X 5"
-or-					
(min)	2.5X	.	2" X 2"	=	5" X 5"
(max)	5.0X	.	1" X 1"	=	5" X 5"
-or-					
(min)	3.0X	.	2" X 2"	=	6" X 6"
(max)	6.0X	.	1" X 1"	=	6" X 6"

d. Printing of both stereo conjugates side-by-side on one sheet of film.

e. Anamorphic magnification ratio of 1:0.5 (vice 1:2).

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f. 360° Image rotation (probably by means of a prism).

g. System three-color achromatized at 450, 550, and 650 nanometers.

5. Prior to the 31 July discussion, [] was speculating that we might prefer a 9" X 9" output format. For this size he was estimating a 64" object-to-image plane dimension, 20" of optics and a semi-field angle of 10°. For reasons of distortion correction, they would prefer a 6°-7° semi-field angle, which would result in an 82" object-to-image plane. However, by reducing the output format to 5" or 6" square, design problems would be alleviated. Telephone conversation on 12 August indicates some concern by the lens designers and we have agreed to meet at [] during the first week of September when substantial feedback will be available.

6. Although a 200 l/mm specification is referenced in the project proposal, we had not discussed the off-axis effects of the printer design prior to 31 July. At that time, [] indicates that their design goal is 200 l/mm anywhere on the output format, but further analysis during the lens design effort will be required to specify. [] is considering using a proprietary lens evaluation program; after the lenses have been designed; however, current funds may not be sufficient since it takes several weeks to run. A major question is to be decided concerning the type of anamorphic system which will be selected (as indicated in the proposal). I have specifically requested this information at the earliest possible time.

7. The "kluge" breadboard printer will be an unpainted tubular weldment with sufficient mass, rigidity, and vibration isolation to permit testing at the contractor's [] plant where development is going on. Exposure control and filter changing will be manual. The individual lens assemblies will be fabricated with ring gears so that servo controls could be added easily if optical tests are satisfactory. In fabricating the objective lens, three of them may be started if economically feasible. Only one would be completed but the partial fabrication of others provides a safety factor in case of damage -- eventually, at least two will be needed for any possible follow-on effort. Test procedures on the "kluge" will be defined in the future.

8. By starting Lens Design on 1 August 1969 we have speeded up the schedule by 30 days; nevertheless, [] thinks that the test schedule may be threatened next year. Both lens design and lens

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fabrication may take more time than originally scheduled and he has been told that everything must stop on 30 June 1970. I have talked to the Contracting Officer, who indicates there are at least two contractual steps that can be taken to extend the work, assuming funds have not been exhausted.

9. I have been informed that a message dated 12 August, concerning technical problems was forwarded to Messrs. [] and [] and it calls for a design decision. Pending my detailed reading of it, I assume that my planned early September visit (see paragraph 5 above) will be the proper time to respond.

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23X1

[]
SRB/RED/TSSG

25X1

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